INSTALLATION SUPPORT INFORMATION SYSTEM

COLLABORATIVE TOOL

Field of the Invention

5   This invention relates to lifetime
support and depot operations, and more
particularly to projection of job completion
dates.

Background of the Invention

In the context of lifetime support
10   and depot operations, it may be necessary from
time to time to upgrade or update a major piece
of equipment, such as a ship or aircraft. In
the case of a ship, these upgrades or updates
are planned years in advance, and the necessary
15   parts and equipment are procured in advance of
the upgrade. Many of these parts and
equipments have long procurement times. The
steps of the methods necessary to perform the
upgrades are also planned well in advance of
20   the actual implementation of the upgrade. The
equipments and materials needed for the
upgrades will, in general, not become available
simultaneously, but rather must accumulated
over a period of time of months or even years,

thus requiring key business partners to participate in real-time, dynamic exchange of lifetime support and depot operational components.

5   When a ship or other major item is to be upgraded, there is a planned starting date for the job, which may be related to availability of a dry-dock or other major site or equipment. It is very important to assure

10 that the parts and equipment accumulation is finished or completed by the starting date for the project. It is also important to maintain records which make it possible to predict the projected date by which all the materials will

15 have been accumulated. This record keeping is difficult because many of the required materials arrive as parts of a "alteration kit" of parts, one of which is associated with each aspect of the upgrade. For example, the

20 materials and equipment for upgrade of a particular radar or electronics system of the ship is shipped as a single assemblage. If two such radar or electronic equipments are in use on the ship, two alteration kits must be

25 available, one for each unit. Each alteration kit is associated with a bill of lading, which identifies the alteration kit and gives the kit part number. Inside the alteration kit packaging, or associated therewith, is a

30 alteration instruction manual, which includes a list of parts which should be in the alteration kit. In order to verify that all the necessary

parts are contained in each alteration kit when it is received at the site at which materials for the upgrade are accumulated, the alteration kit is opened and inventoried against the

5   alteration instruction manual. The materials must then be repackaged in accordance with specifications in readiness for shipping from the material accumulation site to the upgrade work site. At some point in the accumulation

10   process, lifetime support and depot operations collaborate on the status of critical logistical elements, which indicate what particular components of the necessary alteration kit or kits have been delivered, but

15   as to undelivered materials, has only a manufacturer's promised delivery date upon which to rely. The scheduling of the upgrade is, of course, based upon the promised delivery dates. If these dates are not met, the

20   materials cannot be shipped to the upgrade site so as to arrive in time for the scheduled starting date. If the materials do not arrive on the manufacturer's promised date, then, the upgrade cannot begin, and the upgrade site, as

25   for example a dry-dock, has a ship sitting therein on which work cannot be started, at least as to the missing alteration kits. Such late-arriving alteration kits can be stored until a later scheduled upgrade time, possibly

30   years in the future, but cannot be installed during this particular scheduled upgrade interval.

Spare parts must be provided for those parts of a ship, which are likely to break down during operation. Spare parts may be included in an alteration kit, or they may

5   arrive separately. When the spare parts are part of an alteration kit, the spare parts provided therewith must be correlated with the list of on-board spare parts so that they can be checked off as received. Spare parts

10   received separately from an alteration kit can be simply checked off the spare parts list.

Each ship upgrade requires upgrading of the technical manuals associated with the upgraded equipment so that the upgraded

15   equipment may be properly maintained. If the technical manual is classified, it must be treated differently than spare parts. Documentation must be provided for the handling of the technical manuals, and their arrival in

20   time for the upgrade must be considered.

Preventive maintenance schedule documentation can be handled in the same manner as technical manuals. In addition to technical manuals required for maintenance, technical

25   manuals and instructions must be provided for each upgrade to be performed.

The difficulty of maintaining records and of making the determination is further compounded by the fact that different classes

30   of ships may have equipments in common. For example, a radar or communication system may find use not only in a given class of naval

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vessels, such as destroyers, but also in some
other class of ships, such as cruisers or even
tankers. In some cases, similar ships of the
navies of other countries may be impacted.

5   The determination of the status of
completion of accumulation of all the
alteration kits, spare parts, and manuals and
other documentation associated with upgrades is
a very difficult task.

10   Improved methods are desired for the
determination of the status of accumulation of
the necessary equipments for an upgrade of a
major asset.

Summary of the Invention

15   A method according to an aspect of
the invention is for determining the Integrated
Logistic Support (ILS) date for any particular
ship upgrade or alteration. The method
resolves potential discrepancies and delay of

20   information flows by providing real-time
collaboration against the ILS date. The method
includes the step of generating change
documents for correcting at least some
perceived problems associated with a particular

25   type of equipment associated with at least one
major asset, which in the described embodiment
is a ship. In a computer, each the change
documents is associated with the identities of
one or more ships having the particular type of

30   equipment. At least one of the major assets
having the particular type of equipment is
scheduled for upgrade beginning on a particular

date. A promised delivery date for each
alteration kit associated with each ship
upgrade is obtained from material vendors. A
particular ship upgrade is selected for which
5   the ILS date is desired. For the selected ship
upgrade, that one of the promised dates which
is most remote in time is selected, and deemed
to be the ILS date.

10   Brief Description of the Drawing
               FIGURE 1 is a simplified illustration
of the environment in which the invention is
useful; and
               FIGURES 2a and 2b together represent
15   logic or activity flow according to an aspect
of the invention, at least part of which is
performed on a computer.

               Description of the Invention
20   In FIGURE 1, an upgrade of a ship 10
is scheduled for a particular date, and the
ship should be in a dry-dock or other facility
12 on the scheduled date. Prior to the
scheduled starting time for the upgrade,
25   alteration kits, illustrated as crates 14,
spare parts packages 16, and documentation,
illustrated as manuals 18, arrive at various
times, as suggested by arrows 14a, 16a, and
18a, at a warehouse or other storage facility
30   20. Once the materials for the upgrade have
been accumulated at storage facility 20, the
materials are transported, as suggested by

arrow 22, to a site, storage building or warehouse 24 near the site or facility 12. The materials are thus readily available for the upgrades as work progresses. It will be

5 appreciated that the various sites at which the alteration kits, spare parts, and documentation are manufactured or fabricated may be at various widely spaced locations, and may even be continents apart. Similarly, the warehouse

10 20 may be on one continent, and the facility 12 on another. The administrative control center 30 for the various upgrades may itself be distant from all of the other facilities of FIGURE 1.

15 According to an aspect of the invention, the administrative control center 30 of FIGURE 1 has access to a computer system, illustrated in FIGURE 1 as a box 31. Computer system 31 includes a database. The database

20 contains information which may be useful to various ones of the manufacturers or vendors of the alteration kits, spare parts, and/or documentation. In order to provide timely information to the administrative control

25 center and to the interested parties, all of the facilities, including computer 31, warehouses 20 and 24, and facility 12, and even ship 10, may have connections to the Internet, illustrated as a cloud 32, and the database may

30 be made available for reading from remote sites by way of the Internet. The location of the computer system 31 is not associated with any

location in FIGURE 1, since the computer system
may be distributed, and in any case, even if
"centralized" in a single computer, it is
available to all locations by way of the

5   internet 32.

FIGURES 2a and 2b together form a
simplified flow diagram illustrating the logic
associated with computer 31 and the outside
world to allow determination of the

10   availability of the various elements required
to perform an upgrade on a particular ship or
other major asset. In FIGURE 2a, item 210
represents a logic start block, and the logic
flows to a decision block 212. So long as a

15   change to a ship is not perceived as being
required, the logic exits decision block 212 by
the NO output, and flows back to the Start
block 210. Eventually, one or more upgrades
will be required, in which case the logic

20   leaves decision block 212 by the YES output,
and arrives at a block 214. Block 214
represents the generation of a change product
document. The change product document is
prepared by an engineer or engineering team in

25   response to a perceived deficiency in the
nature of the ship or other asset. Such a
deficiency might be premature degradation of
some item of machinery, electronics or
software, or it might represent an enhancement

30   of the performance of some item such as a radar
system. The change document includes a title
of the change document, a rough solution to the

perceived problem, the identification of the system which is impacted, and includes the estimated cost, and also includes much other information, such as description of the

5   problem, drawings which must be changed, proposed vendors for the various parts, and the like. Since the change document produced in response to block 214 is generated in response to a perceived problem, it can apply only to

10   those certain classes of ships fitted with the type of equipment in which the problem arises.

From change product creation block 214, the logic flows to a decision block 216, which determines whether the class of ship in

15   question is affected. If not, the logic returns to block 214 by the NO output of decision block 216. If the change product order affects ships of the class in question, the logic flows from the YES output of decision

20   block 214 to a block 218, which represents the assignment of an alteration number to the change product order. Thus, the change order is associated in the database with a particular alteration (major upgrade) of a particular

25   ship. The resulting combined information relating to the change product order and its associated alteration(s) is entered into the database, as represented by block 220. After the information is entered into the database,

30   the database can be interrogated, as suggested by block 222, to create a detailed Integrated Logistic Support (ILS) analysis report (DIAR)

or an Internet Alteration Installation Support Information System (IAISIS) analysis report or document, as suggested by the YES output of block 222. If such a report is not currently

5   desired, the logic leaves block 222 and returns by the NO output to block 218 for assignment of another alteration number.

From the YES output of block 222 of FIGURE 2a, the logic flows to an array 230 of

10   decision blocks, including decision blocks 230a, 230b, 230c, 230d, 230e, 230f, 230g, 230h, 230i, 230j, 230k, 2301, and 230m. The NO output ports of the decision blocks of set 230 are joined together, and a NO logic output from

15   all of the decision blocks of set 230 causes the logic to flow to a block 232, which represents a lack of an impact on the elements required. There is a yes label at the input of each decision block because at each block there

20   is a decision of yes or no. If the decision is yes, the block becomes part of the ILS engine to determine the date. If the decision is no, then there is no ILS impact. If there is an impact on the elements, then the logic flows to

25   block 234, representing the determination of the Integrated Logistic Support (ILS) date.

More particularly, decision block 230a of FIGURE 2bdetermines from the database whether a Tailored Repairable Items List (TRIL)

30   is required. If not, the logic flows to block 232. If TRIL is required, the logic flows to an input port of a block 234, the One-

Integrated Logistic Support (ILS). Similarly, decision block 230b determines whether training is required to implement the alteration of the ship in question, and the logic flows to block

5   232 if no training is needed, and to block 234 if training is needed. In the same fashion, decision block 230c determines whether the Allowance Parts List (APL) is required, decision block 230d determines whether

10 technical manuals are required, block 230e determines whether a Preventive Maintenance Schedule (PMS) and Maintenance Requirement Cards (MRC) are required, block 230f determines whether shipyard Installation and Checkout

15 Spares List (INCO) is required, block 230g determines whether an Alteration Installation and Checkout Spares List (INCO AL) is required, block 230h determines whether Coordinated Shore Base Material Allowance List (COSMAL) is

20 required, block 230i determines whether Support and Test Equipment (S&TE) is required, block 230j determines whether Maintenance Assist Modules (MAMS) is required, decision block 230k determines whether an On-Board Allowance (OBA)

25 is required, and decision block 230l determines whether alteration instructions are required, and each advises block 234 if there is a requirement, or routes its logic to block 232 if there is no requirement. Similarly, the

30 logic from block 222 of FIGURE 2a also flows to block 230m of FIGURE 2b, which determines whether alteration parts kits are required. If

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no alteration parts kits are required, the
logic flows from the NO output port of decision
block 230m to block 232. If alteration parts
kits are required, the logic flows to a block

5   236, which represents the determination of the
promised delivery date for those not yet
arrived.

If the determination is made in block
231 that an alteration parts kit is required,

10   the logic flows to a block 236, which
represents the determination of the estimated
delivery date (EDD) on which the parts kit will
become available. Block 236 yes output
monitors only the Estimated delivery date of

15   the Alteration kit. These kit items are not
considered to be decision inputs to
determination of the ILS date, but used in a
decision to determine whether work can begin on
the ship on a specified date. The Estimated

20   kit Delivery Date, block 236, is provided to
block 238, which compares the estimated kit
date and/or the ILS date, block 234, with a
date (which may not be the current date) at
which it is desired that work begin, to

25   generate an output indicating whether work can
begin on the ship on the specified date.

One Integrated Logic Support block
234 of FIGURE 2b responds to the YES outputs
from one or more of the decision blocks of set

30   230, to determine the date on which each of the
selected or "YES" elements arrived or is to
arrive, and to select from among those dates

the last or most remote date representing the longest lead time. At the time that this determination is made, the specified date may be in the past, in the present, or in the

5   future. The ILS date is provided to a block 238, which compares the ILS date with the date (which may not be the current date) at which it is desired that work begin, to generate an output indicating whether work can begin on the

10   ship on the specified date.

Other embodiments of the invention will be apparent to those skilled in the art. For example, the determination of the Integrated Logistic support date is related to

15   the configurable logistical elements entered into the database.

Thus, a method according to an aspect of the invention is for determining the ILS date for any particular ship upgrade or

20   alteration. The method resolves potential discrepancies and delay of information flows by providing real-time collaboration against the ILS date. The method includes the step of generating change documents (block 214) for

25   correcting at least some perceived problems associated with a particular type of equipment associated with at least one major asset, which in the described embodiment is a ship. As maintained in the database (31), each of the

30   change documents is associated (block 214) with the identities of one or more ships having the particular type of equipment. At least one of

the major assets (ships in the example) having
the particular type of equipment is scheduled
(block 220) for upgrade beginning on a
particular date. A promised delivery date for
5   each alteration kit associated with each ship
upgrade is obtained (block 236) from material
vendors. When a particular ship is scheduled
to become available for update, that particular
ship upgrade is selected (block 216) for which
10   the ILS date is desired. For the selected ship
upgrade, that one of the promised dates which
is most remote in time is selected (block 234),
and deemed to be the ILS date. If the ILS date
is prior to the date on which that ship becomes
15   available for upgrade, the upgrade can proceed
on that ship. If the ILS date is later than
the time at which the ship becomes available
for upgrade, the upgrade cannot be performed a
the time at which the ship is available, and
20   those portions of the ship upgrade which cannot
be scheduled for the ship's scheduled date in
dock for repairs can be rescheduled for a later
time at which the ship becomes available. As
an alternative, some action can be taken to
25   improve the delivery time of any one of the
various upgrades which may be deemed to be
critical.